

CLAIMS

- 1- A system for augmentation of satellite positioning systems, comprising:
- 5 - a satellite based augmentation system having at least one monitoring ground stations (MGS) for determining a level of error of a satellite (NS) broadcasting positioning signals and at least one navigation computation center (2), said navigation computation center (2) providing navigation correction data for transmission, and;
 - 10 - a digital satellite system using at least one digital satellite (DS) broadcasting multiplexed data in down-link transmission to a user station (U);
- characterized in that at least one navigation computation center (2), is adapted for transmitting, directly or indirectly through intermediate equipment, said navigation correction data to said at least one digital
- 15 satellite (DS); and said user station (U) has at least one satellite receiver (6), receiving directly or indirectly through any kind of retransmission said digital satellite signal, and being connected to at least one down-link frame adapter (7) for demultiplexing and retrieving said navigation correction data from said at least one digital satellite down-link
- 20 transmission.
- 2- A system according to claim 1, wherein at least one of said navigation computation center (2) is connected to an up-link frame adapter (3) for framing said navigation correction data into a format and rate adapted for digital up-link transmission through said digital satellite (DS).
- 25 3- A system according to any of the previous claims, wherein said multiplexed data is multiplexed on-board said digital satellite (DS) or on ground, and protected with a system transmission forward error correction mechanism compatible with said digital satellite (DS) and receiver (6).
- 4- A system according to any one of the previous claims, wherein said
- 30 navigation correction data are contained in a fraction of a signaling channel associated to or embedded within a communication channel of said down-link transmission, or located in a fraction of the communication channel itself;
- 5- A system according to claim 4, wherein said signaling channel is adapted for conveying data needed for retrieving, synchronizing, decoding or
- 35 processing a communication channel in a system using said digital satellite

(DS), and wherein it further contains at least one field reserved or assigned for transmission of auxiliary lower rate data capable of being synchronized with data or data frames transmitted in other parts of said communication channel.

- 5 6- A system according to any one of the previous claims, wherein said navigation correction data are transmitted from at least one of said navigation computation center (2) to said up-link frame adapter (3) through a satellite link.
- 7- A system according to any one of the previous claims, wherein a user
10 station (U) is adapted for receiving navigation correction data from a plurality of navigation computation centers (2), and is capable of selecting navigation correction data transmitted from one of said navigation computation centers (2) or combine data received from more than one of said navigation computation centers (2).
- 15 8- A system according to any one of the previous claims, wherein said user station (U) is mobile or can be placed successively at various locations.
- 9- A system according to claims 2 and 4, wherein said up-link frame adapter (3) is adapted for extracting, from correction navigation data transmitted by said navigation computation center (2), data related to time or other specific
20 data such as Global Navigational Satellite System – GNSS - almanacs and allocate said data as computed for a specific point into a specific portion of the said signaling channel.
- 10- A system according to claim 1 and 4, wherein said down-link frame adapter (7) is adapted for extracting from said satellite down-link
25 transmission data related to time or other specific data such as GNSS almanacs from a specific portion of said signaling channel.
- 11- A system according to claim 1, where said down-link frame adapter is incorporated in a correction unit (8) or in a receiver (6) of said user station (U).
- 30 12- A down-link frame adapter (7) as claimed in claim 1.
- 13- A down-link frame adapter according to claim 12, wherein it is capable of converting data framing from said satellite down-link data channel rate to a format suitable for a conventional global navigational satellite system receiver or a software using global navigational satellite system data.
- 35 14- A receiver (6) as claimed in claim 10 and 11.

15- An up-link frame adapter as claimed in claim 2.

16- An up-link frame adapter according to claim 15, wherein it is capable of converting correction data format from said navigation computer center to an up-link format adapted for said digital satellite system.

5 17- A method for augmentation of satellite positioning systems, said system comprising:

- a satellite based augmentation system having at least one monitoring ground stations (MGS) for determining a level of error of a satellite (NS) broadcasting positioning signals and at least one navigation
10 computation center (2), said one navigation computation center (2) transmitting navigation correction data, and;
- a digital satellite system using at least one digital satellite (DS) for broadcasting multiplexed data in down-link transmission to a user station (U);

15 characterized in that said navigation correction data is transmitted by said at least one navigation computation center (2) to said at least one digital satellite (DS); and said user station (U) de-multiplexes and retrieves at least one of said navigation correction data from said at least one digital satellite down-link transmission by means of a down-link frame adapter (7) connected
20 to at least one satellite receiver (6).

18- A method according to claim 17, wherein said navigation correction data are stripped from forward error correction related bits, framed by a frame adapter (3) receiving data from said navigation computation center (2), into a frame format and rate adapted for digital up-link transmission.

25 19- A method according to claim 18, wherein specific data recognized from said navigation correction data are replicated, re-formatted and inserted into at least one specific field of said signaling channel of said digital satellite (DS) system.

30 20- A method, according to any one of the claims 17 to 19, wherein data related to time is broadcast to the user, said time being the time evaluated in relation to a specific point characterized by its latitude, longitude and altitude, as per a reference datum used by a global navigation system.

21- A method, according to claim 18, wherein:

- a first time information is provided to the down-link frame adapter (7), to the receiver (6) located at a first location, or a correction unit (8) of a user station (U);
 - 5 - partial or complete information on a second, pre-determined location is transmitted to the user station (U) enabling to determine said second point positioning parameters such as, latitude, longitude and altitude thereof, as per a reference datum used in a global navigation system; and
 - 10 - a compensating time difference is calculated for the correction unit (8) by algebraic addition of propagation time difference between a satellite and said first location as compared to that of said satellite and said second location.
- 22- A method, according to claim 18 or 19, wherein data related to time is transmitted in a format suitable for a conventional receiver (6) for a digital
- 15 direct broadcasting satellite system and is used for triggering transmission of information or for displaying information to a user.
- 23- A method according to claim 18 or 19, wherein GNSS almanacs are transmitted in parallel to other navigation correction data through said specific fields of said signaling channel of said digital satellite system.